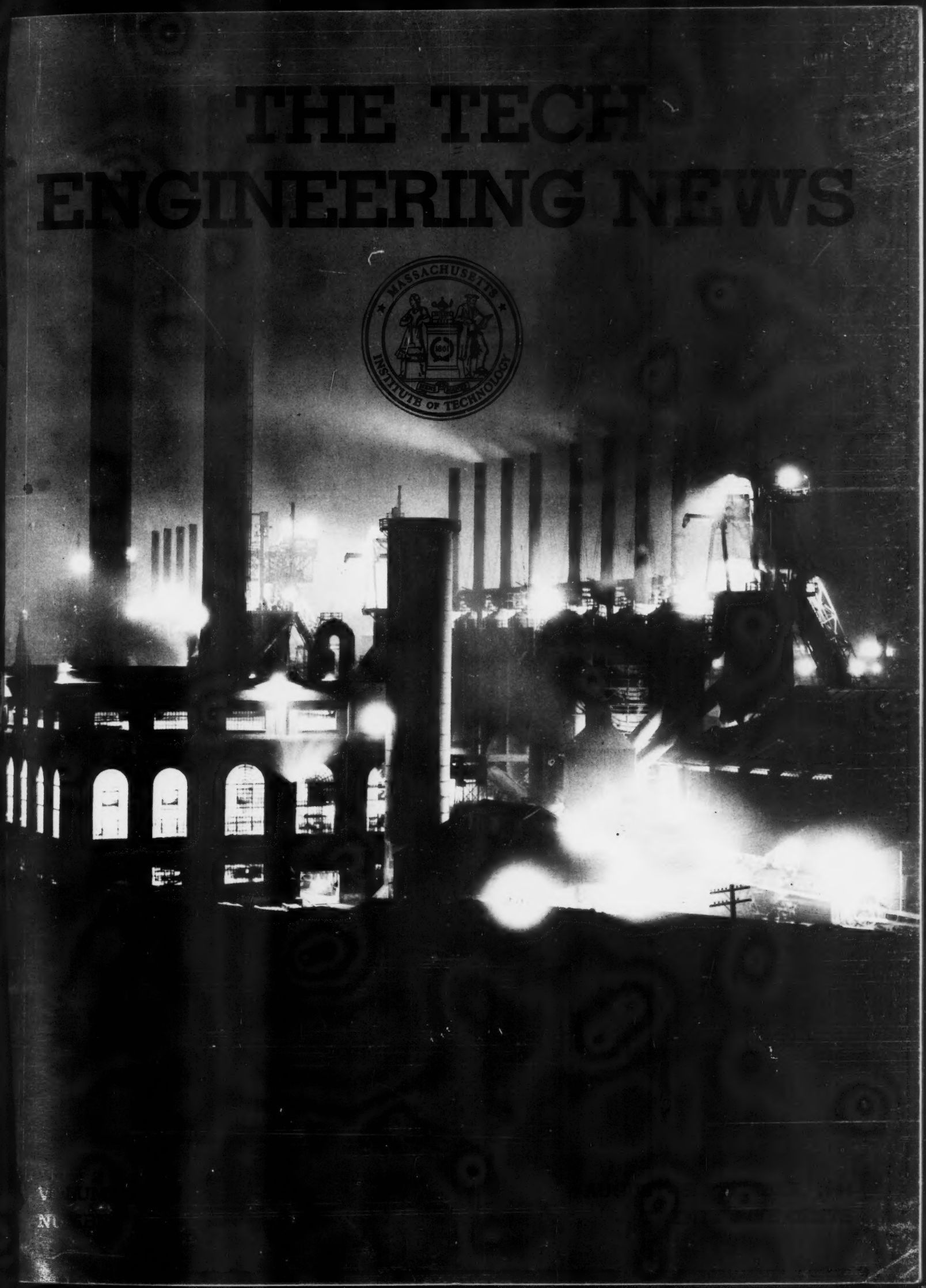
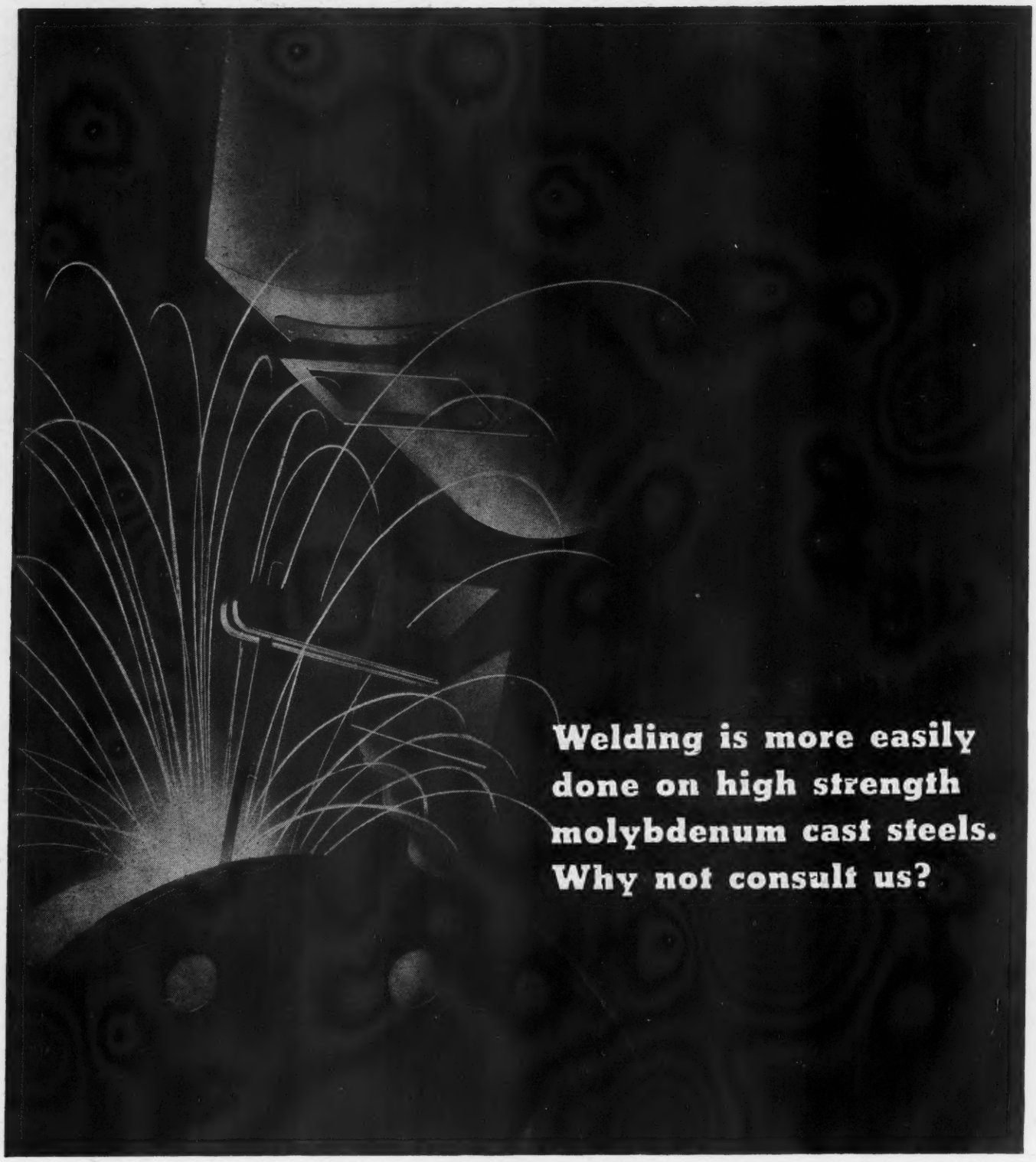
THE TECH ENGINEERING NEWS





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ARMY E NAVY

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MOLY

KEEPING UP WITH *Electricity*

TRADITIONALLY a welder is surrounded by the haze of smoke. Now a portable Precipitron*, the electrostatic air cleaner, is used by industry to eliminate the welding smoke. The unit clears 600 cubic feet of air per minute.

COUNTING THUNDERBOLTS is the task of a new device which has been thrown into the campaign to protect power lines from damage by lightning. It consists of a saw-toothed and a straight-edged strip of metal foil between two layers of transparent plastic, and is about the size of a playing card. When lightning strikes a power line, a bit of the lightning is deflected to the foil, jumps the gap from one tooth to the straight-edge. In so doing it scorches a black spot on the plastic and also burns away that saw-tooth, so that the next discharge must travel by another path. No two teeth are the same size; each discharge picks the shortest path and thus is registered only once.

ARCHERY AND ELECTRONS are working together in that most modern of scientific instruments, the electron microscope. Quartz filaments 1/30,000 of an inch in diameter—one-sixteenth the thickness of a human hair—are used to calibrate the magnifying power of these microscopes. Westinghouse engineers have found that a modification of the medieval cross-bow is the simplest and most efficient device for drawing out molten quartz into such a filament before it can cool or harden.

• • •

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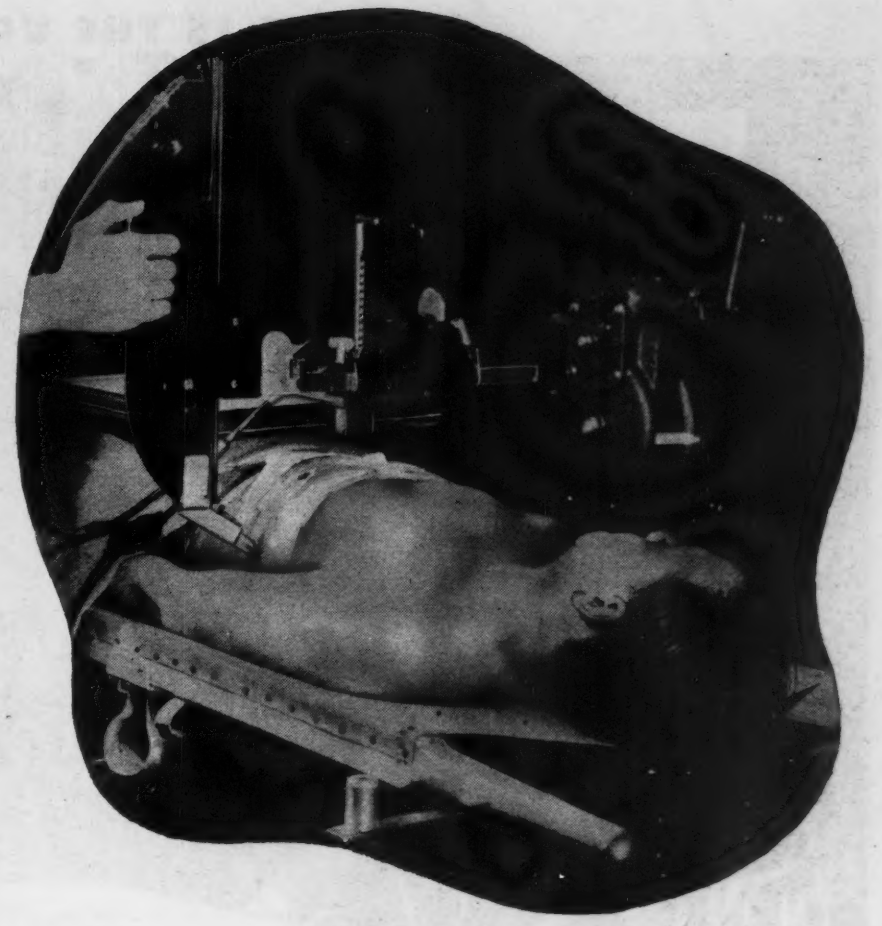

Surgery by triangulation

The life of a soldier wounded by a bullet or shell fragment may depend on the speed with which the metal can be located and removed.

Today, in army field hospitals, *only one minute* is required to discover the fragment and locate it in two planes, incidentally giving the surgeon two points at which incision may be made and also the correct angles and depths beneath the skin.

This is made possible by the Westinghouse Bi-Plane Marker, a device which translates the conditions shown by the fluoroscope into "guide posts" for the surgeon's knife.

Used with the Bi-Plane Marker is the Re-orientating Device, which makes certain that the position of the patient on the operating table is exactly the same as during the fluoroscopic examination.

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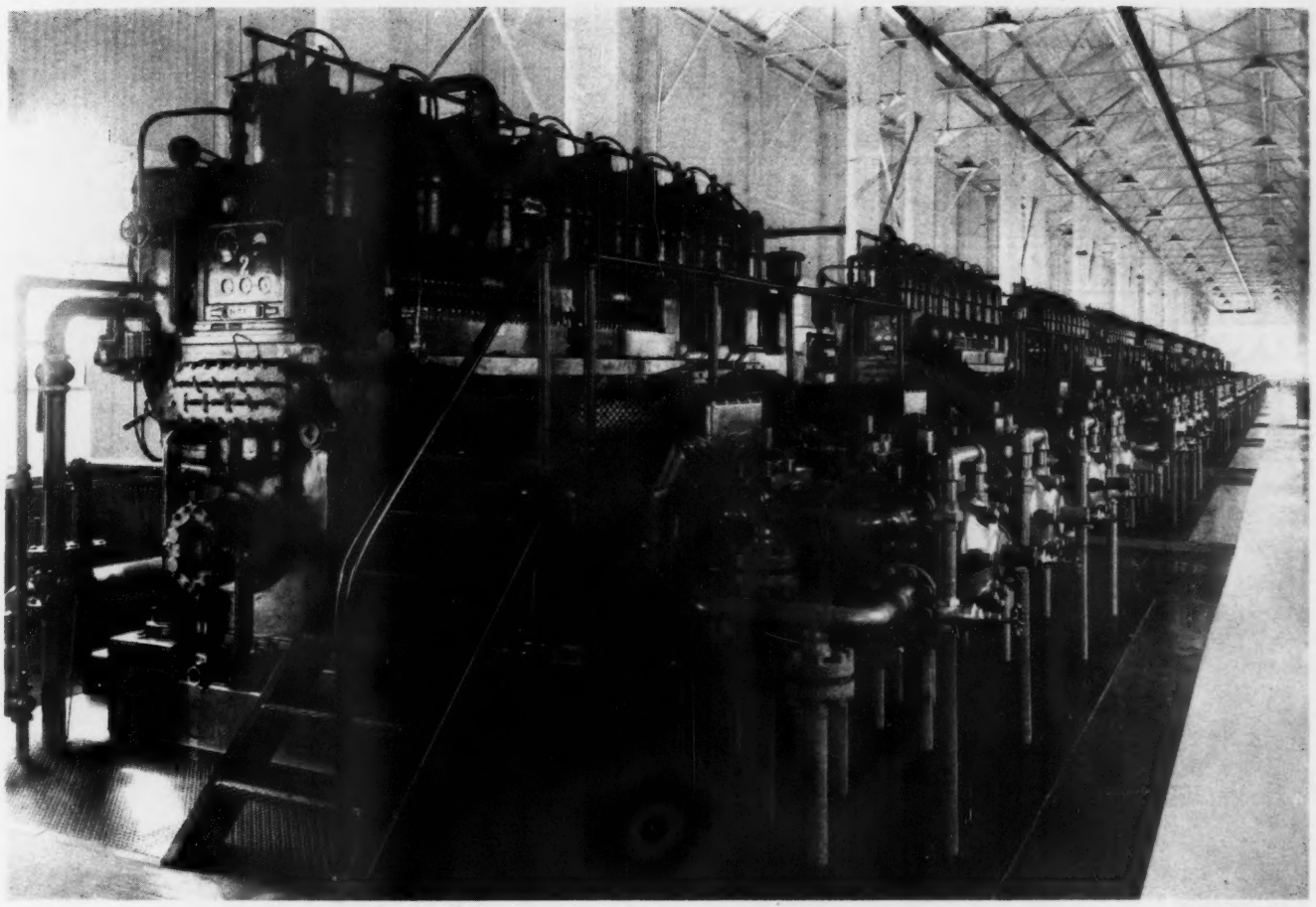
This tiny outpost is one of the most important voices of France —and Freedom—in the world.

H.R.O. receivers are standard equipment used exclusively in this station for monitoring and rebroadcasting. Brazzaville is the Voice of France, and these receivers are the Ears of Brazzaville.

NATIONAL COMPANY

MALDEN MASS, U. S. A.

NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD



Eleven 8-cylinder 800 BHP CLARK "Angles" in La Gloria Corporation Recycling Plant, Falfurrias, Texas.

Achievements in the Field

PACIFIC PUMP WORKS

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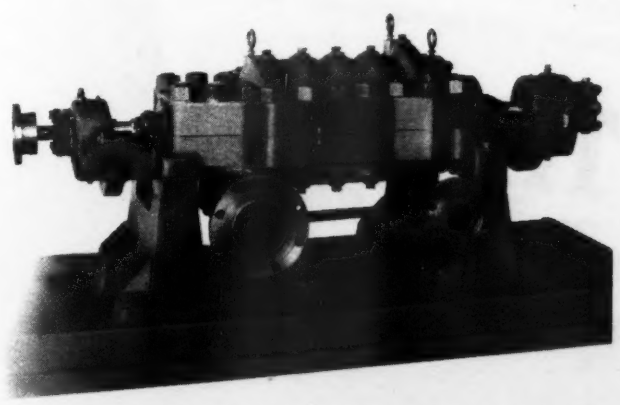
Illustrated below is one of the many types giving unsurpassed service in this important field.



Pacific Type JBMB—Size 3-inch precision engineered 5-stage Boiler Feed Water Pump No. 7138, installed in a large Western oil refinery.

CLARK BROS. CO., INC.

This battery of eleven 8-cylinder, 800 BHP CLARK "Angles" in the recycling plant of the La Gloria Corporation, near Falfurrias, Texas, is one of the largest compressor plants ever placed in operation. The daily capacity is 185,000,000 cu. ft. of gas.

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Clark Bros. Co., Inc. and Pacific Pump Works are individually operating members of the Dresser Industries.

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LEARN TO KNOW YOUR BEARINGS

The post-war world will be mechanized to an extent that cannot be completely foreseen now. Wheels and wings will play a greater and more important part in the world of the future than ever before—and so, consequently will bearings.

In view of the present dominant position of Timken Tapered Roller Bearings, it is not too much to say that these bearings will figure still more importantly in future mechanical developments; for there are few bearing requirements that Timken Bearings cannot meet.

So while you still are studying, it will pay you to learn to know Timken Bearings thoroughly—their design, application, and potentialities. Then you'll be still better equipped for your job when college days are over and you begin your career as a full-fledged engineer. The Timken Roller Bearing Company, Canton 6, Ohio.

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THE TECH ENGINEERING NEWS

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OF THE UNDERGRADUATES

MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

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THIS IS M. I. T.

INTER-PROFESSIONAL RELATIONS— THE ARCHITECT AND THE ENGINEER

By WALTER R. MacCORNACK
Former Dean of the School of Architecture, M. I. T.

MOST of the discussions in professional societies revolve around the problems of that society. They are in the same category as the nations of the world, most of whom have assumed an isolationist attitude, except where it seems to be to their benefit economically to do otherwise. One of the serious conditions in the building industry today is the lack of co-operation between various groups, the almost complete ignorance of one another's activities, and the lack of a co-ordinated program defining the functions of each in the building construction field. Thus, we find architects calling themselves "architectural engineers" and the engineers calling themselves "architects" without either one fully appreciating the background of the other, or the logical field of activity which each might undertake for the benefit of the consumer known as the building public.

Over the main entrance of the Massachusetts Institute of Technology appear these words: "School of Architecture, Engineering, and Science." This should be enough to indicate that these three groups have a definite function in our economic life and each is entitled to the dignity of its position. This leads to the inclusion, on a basis of equality, of the three groups in the building industry recovery program which we are now facing. It is all too common to find architects hiring engineering draftsmen to do their work, thus by-passing the legitimate engineering profession. It is likewise well-known that engineers hire architectural draftsmen to do their architectural work. This has only resulted in inferior engineering and architecture in these two respective classifications.

There seems to be a prevalent idea that certain types of buildings should have no architectural merit and are, therefore, purely an engineering activity. Bridges and dams fall in this category. Similarly, the engineering in many important buildings has oftentimes been treated too lightly by the architectural profession. There are three distinct subdivisions in the building industry, all of which it would seem logical to treat from both the architectural and engineering standpoints. The first section is that in which the architectural work largely predominates. In it are the normal buildings of everyday life, consisting of educational buildings, hospitals, public buildings, office buildings, hotels, and the like. At the other end of the line fall the structures which are largely engineering in their scope. Such projects as have been mentioned before are dams and bridges. In the middle lies the third classification — large power plants and industrial buildings.

If the architects and engineers would come to some mutual understanding of the rightful activities of each group, then more engineering of a sound character would be brought into our architectural structures and more architectural merit into the buildings which are now neglected. Too often in the past, the architect calls the engineer in a little too late to produce the quality of the work he should produce. On the other hand, an engineer may call an architect in on a bridge at the last minute to give it some kind of architectural respectability, such as abutments, which are not logically designed with respect to the expression of the structural strength of the bridge. Recently three very distinguished lectures were delivered at Cambridge University in England on this very subject. They were scholarly in their approach and thoroughly logical in their content. The architects and the engineers should in no way be rivals for the same type of work, but rather co-operators in bringing about more orderly, more logical, and more beautiful structures.

The types of engineering involved with the architecture for the coming reconstruction program are, of course, foundation engineering, structural engineering — including concrete, masonry, steel, and timber — heating and ventilating, electrical work, and sanitation. In addition to these, occasionally come elevators and air-conditioning.

At times during the present war it has become apparent that there was a misunderstanding of what the architect could do. He was largely described as a picture maker and relegated to a position outside the pale of usefulness in the war effort. However, the usefulness in the war effort of the architects has been pretty thoroughly demonstrated, since their training in

(*Continued on page 26*)

This is an excellent example of a product of South American engineering
Three Lions

PAN-AMERICAN TECHNOLOGY

By CURT B. BECK, 6-45

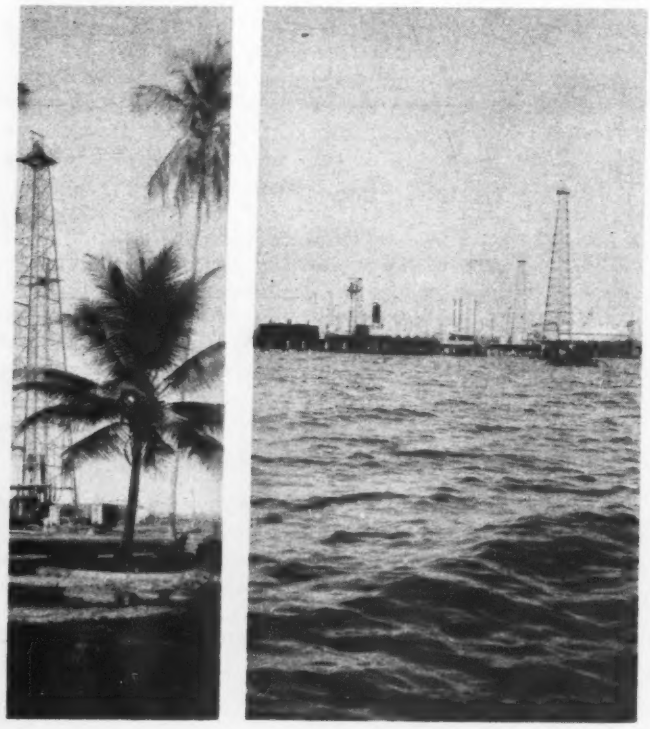
Contributing Editor, The Tech Engineering News

NOW that Victory appears to be nearer than Allied plans would have predicted earlier in the war, popular thought is turning towards the question of the organization of a future world. Elaborate plans are being made and are being expounded by ardent enthusiasts of European and Asiatic causes, but strangely enough little is appearing on postwar plans for South America.

Set off to a bad beginning, our relations with our southern half have not always been the best — it has just recently been true that the era of North American "Big Business" exploitation and the policy of the "Big Stick" have been shown to be past history.

Thus, it is an unfortunate background that meets the postwar engineer planning to make South America his headquarters, for Americans can and will make a great contribution to postwar Latin America.

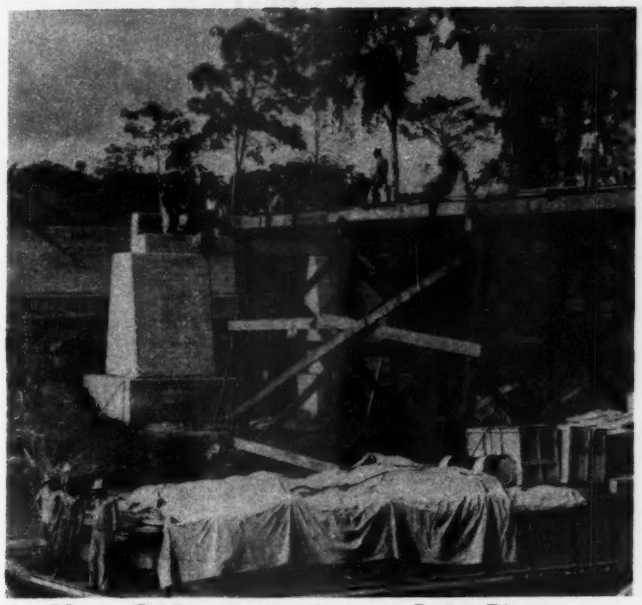
Oil wells in Venezuela *General Electric Company*



South America is in a hemisphere in which the resources have remained relatively undeveloped, a fertile field for the engineer. But the fact remains, it has not been as potent a drawing card for the engineer as other fields. The working conditions are not always pleasant for him, he is in a foreign country — often he is in the backwoods in a climate and locale that is totally new and apart from that of his home. He may have to bide his free time there for want of adequate transportation facilities. Also, the thought of leaving the United States does not appeal to some, and the idea of working in South America has been shunned and has never appealed to a majority of American engineers.

These are some of the main problems that face South American businessmen and impede the development of South American industry. For, while there are some excellent technical schools in South America there still is a need for engineers which greatly exceeds the supply, a need which we can fill. The demand vs. supply situation has been so acute that at times whole industries and new plants have had a delayed opening, or have even been unable to start, for want of engineers to fill the new positions and to start the industry on its way. To be sure, South Americans do matriculate in North American universities in addition to those who attend their home colleges, and these men come back with the superior advantage of knowing another people in addition to their own.

Perhaps one of the first requisites necessary for attracting American engineers to our Southern Hemisphere is a more complete understanding between the two continents. South Americans must be convinced that the egotistical, exploiting, Yankee businessman is past. This will call for a change of policy on both sides. For South American business policies have not always been to the best satisfaction of American businessmen. Nor can South America be rightfully blamed if she is to think of the United States as primarily interested in her exploitation. Thus, when one Latin American country was called upon to supply large amounts of war-scarce copper ore to the United States, it is not hard to see why the export tariff on this one item was greatly increased. "Good Will" funds are not always used as such, a cause for bad feeling among American businessmen. American engineers, through their attitude, and



Los Morros Bridge construction over Caripe River

by their co-operation, can help to dispel doubts as to our intentions.

Consider the natural resources of South America. Most of the world's wool comes from south of the Equator. South America has approximately 100,000,000 sheep, of which Argentina is the largest producer. Most of this wool is shipped to the United States to be processed.

Tin is another important commodity produced by our southern neighbors, and constitutes one of the main sources of revenue for Bolivia. A paradox in the Bolivian tin situation is that most of its smelting is done in England, where it is cheaper to refine it with other ores. In 1939, before the war, $29,000,000 worth of ore was exported by Bolivia, mostly to Great Britain. Here, for example, is an excellent opportunity for the engineer to step in and develop a local industry.

Coal is another South American resource which awaits development. Although many countries are deficient in this commodity, there is coal in Brazil, Argentina, Chile, Peru, Colombia and Venezuela. Chile produced two-thirds of the total (or about 75,000 long tons) in 1936. This coal, together with the oil and natural gas and the abundant water power supply in many of the less-known sections of the continent, furnish an inexhaustible source of power for future engineering operations.

In close conjunction with the coal deposits are the iron deposits, each of which depends upon the other for successful commercial operations. Brazil has large iron ore deposits which await development, and beds also occur in Uruguay, Argentina, Chile, and Peru, of which those in Peru are said to be the most promising.

This list could be carried on indefinitely to include many important materials, such as copper and nitrates. There is a potentially large undeveloped lumber supply in the northern part of the continent, particularly in Brazil, awaiting use. Thus, it is more than evident that South America is still a potential gold mine of natural resources and has infinite promise for the engineer.

Perhaps one of the more significant aspects facing the American engineer contemplating South American employment is the problem of personal adjustment. This problem must be approached from two sides, that of the South American employer as well as that of the engineer. Each must recognize certain facts. The American must not think that he is going down to clean up a fortune and then return, but must go rather with the intention of making his home at his work and becoming a part of the society. He should moreover recognize that he is going not to learn a trade but rather to make use of previously acquired training.

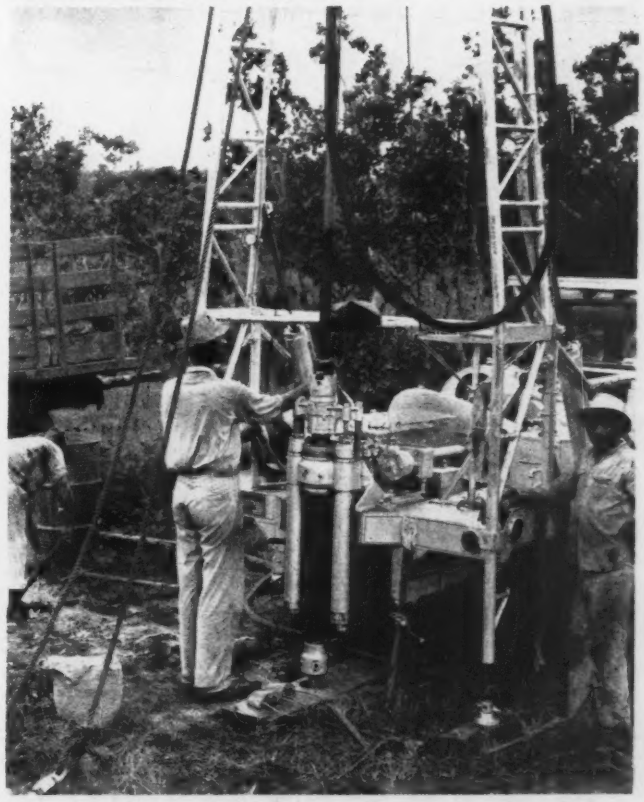
On the other hand the South American businessman must not be led to believe and must not be allowed to continue on the assumption that he is being exploited or that he is dealing with a product of superior education. When good-will funds are used in competition with American businessmen while native resources, in which a basis of international exchange will be developed, are left untouched, there is usually no desire for the American business firm to invest its money and thus supply the necessary impetus to competition in South American industry. And it is false thinking to believe that an increased industrial capacity is not necessary to attract technical skill.

To state the question without offering a solution would not be a complete treatment. Here are a few suggestions:

Why not increase the exchange of students and technical personnel between North and South America? To a certain extent this exchange is going on, and all who participate in it come out with a greatly increased admiration for their neighbors. Fundamentally, each continent has much to be gained from closer relations with its neighbor. South American customs, foods, dances, songs and products, as well as its physical attractions, have always been a favorite of North Americans, and the converse is equally true.

There are impressive opportunities for the American engineer in postwar intercourse with South America, not only in the field of technical developments but also as ambassador of good-will. After he has done his fighting, South America calls him and he must answer.

Portable drilling rig in operation



STRAIGHT AND STEADY

By REUBEN MOULDS, 10-46

Advertising Associate, The Tech Engineering News

Assembling the gyro-horizon *American Air Lines, Inc.*

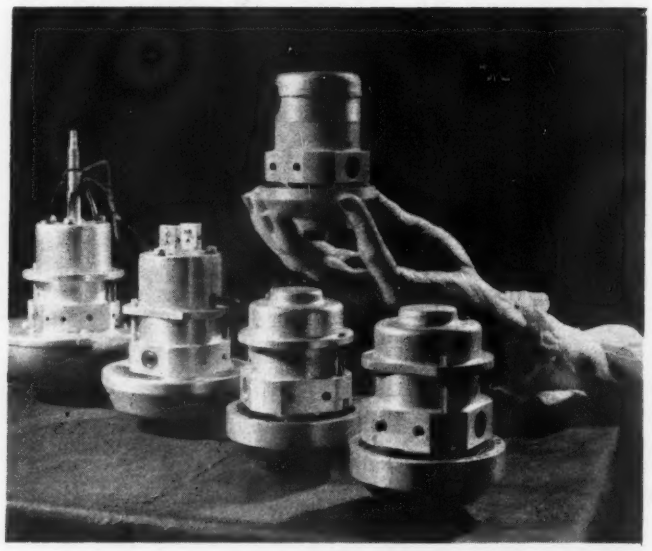
THE gyroscopic principles have been known for centuries, but the gyro remained a child's toy and a preoccupation of mathematicians until Elmer Sperry put it to work in 1911 when he invented the marine gyrocompass. Since then the gyroscope has had a variety of applications, most of them utilizing the gyro's propensity for maintaining a fixed direction regardless of gravity, magnetism, movement, or the earth's rotation. The derivation of the word gyroscope itself — "gyro," to rotate, and "scope," to see — implies this tendency, and with the gyroscope, the laws concerning the earth's rotation can be readily demonstrated.

Although Sperry was the first to successfully use gyroscopic principles to stabilize a ship or to determine direction, he was not the first to see the great possibilities for using the instrument. In 1896 Orby applied the gyroscope to guide the self-propelled torpedo. In 1907, Schlick applied the gyroscopic action to a heavy, yard-wide flywheel to steady a ship at sea, and in 1908 the method was used with small success in Scottish steamers. Also in 1908, Elmer Sperry announced that he had perfected the gyrocompass, but the first model was not installed in a ship until 1911.

The record, therefore, is one of application rather than discovery, and most gyroscopic instruments are very complicated. The gyro itself is relatively simple. When a balanced wheel is mounted in gimbal rings and spun at high speed it develops what is known as gyroscopic inertia and remains fixed in any position in which it is set, regardless of the movement of the gimbals. If the axle of a motor-driven gyro is pointed toward any fixed point and the rotating gyro given a push, the axle apparently refuses to move in the direction of the push. Instead, it jerks away sharply at right angles to the point of pressure. This motion is known as precession. If a weight is hung from the axle bearing (in a horizontal position), this pressure tries to draw the end of the axle downward, but the precession caused by the continuous weight forces the axle to rotate in the horizontal plane that is at right angles to the gravitational force.

To demonstrate more characteristics of the gyro, a weighted rod should be suspended vertically and rigidly from the axle bearings in such a way that when either end of the axle rises, the weight is swung. Assuming that the axle is in an east-west direction the earth's motion causes the east end to precess upward, the rod

Small, vibration-free electric motors for high-speed gyros *Westinghouse*



swings the weight to the east and gravity pulls back on it, thus precessing the axle through the north in a rising arc to a point as far west of the meridian as it was east when it started. However, as the axle went past the meridian to the west, it descended until at the western point it depressed below the horizon, thus the weight also was lifted to the east again and reversed the precession. This moved the axle back to the east through the meridian again. However, by adding a third constant force of partial restraint on the mounting, such as a semaphore arm that is eccentric to the weight on the rod, the east-west oscillation rapidly spirals in to settle on true north.

These peculiar motions of the gyro are used in the gyro compass. The compass proper consists of a binnacle about four feet tall, with a window at the top. The horizontal compass cord is beneath the window, and the gyroscope is suspended from it on a steel wire. The rotor in the gyro forms part of an induction motor and is turned at 6,000 r.p.m. by power coming from the electrical system of the ship. Underneath the gyro case hangs a so-called "mercury ballistic" — three-fourths of a pound of mercury in a pair of tubes on opposite sides of the horizontal gimbal supporting the gyro with a connecting tube between. Bearings at the top of the binnacle permit free rotary movement of the compass cord and hanging gyro so that ship and binnacle turn around the compass.

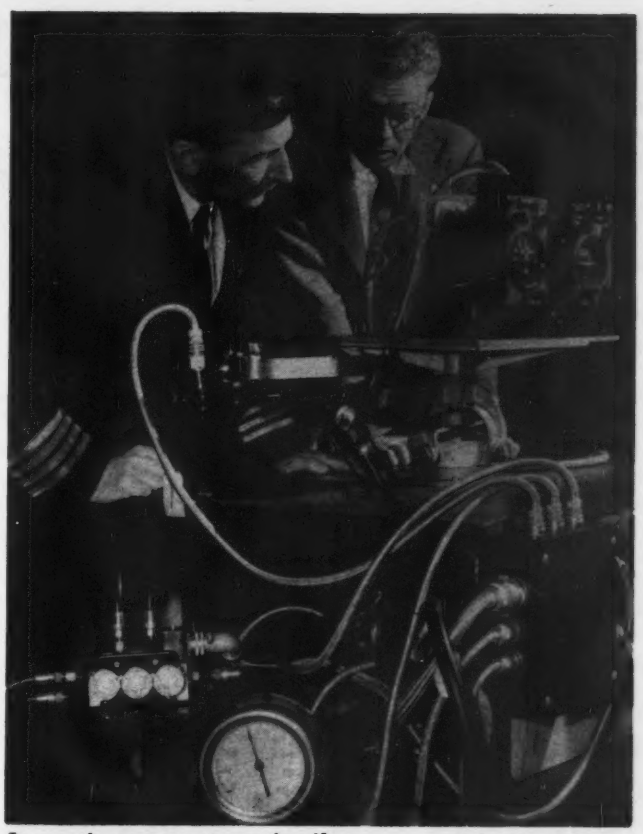
The stabilizer uses the gyroscope to generate heavy precession forces, whereas in all other gyroscopic instruments the fixed directional properties of the spinning wheel are the valuable parts of the device. The precession velocity of gyros varies. Quite large stabilizing gyros for ships precess at measurably one radian; other services often require many radians. Several years ago, one was manufactured for the testing laboratories of the Massachusetts Institute of Technology that precessed at between 20 and 30 radians.

Marine gyrostabilizers were being manufactured and installed in various types of vessels, including submarines, battleships, and big private yachts, in 1913. In 1931, the Italian Line, after years of negotiation, consultation, and planning, announced that the 48,000 ton *Conte di Savoia* would be equipped with a million-dollar stabilizer, the largest ever built. The installation weighed over 600 tons and was capable of cutting a 15-degree roll in a seaway down to a negligible three degrees. On the maiden voyage out of Genoa, the group of engineers aboard waited anxiously for rough weather so they could demonstrate. However, after two full days of calm, it looked as though they would not have a chance to perform a normal test, so they reversed the stabilizer's action and produced a heavy artificial roll, then steadied the ship by switching back to regular stabilization.

The *Conte* stabilizer was a vast success both mechanically and as a passenger draw. However, the stabilizer cost, at least in large ships, outweighed the stabilizer comfort, and today they are not even manufactured.

The stabilizers on the *Conte* help show the power of precession. Three 164-ton gyroscopes were able to stabilize the vessel, although they were equal to only 1.2 per cent of its weight.

Many important aircraft instruments use gyros in their construction. The directional gyro, or DG, weighing less than four pounds installed in its case in the cockpit, consists of a small gyroscope with a twelve-ounce rotor fixed on a horizontal axis and driven by pumped air at a speed of 12,000 r.p.m. The directional gyro is not a true compass. The pilot refers to his magnetic compass first and sets his gyro instrument to correspond with a magnetic heading, afterward ignoring the magnetic compass and getting his bearings from the DG. Actually, he selects a direction from the compass and freezes it on the gyroscope, which remains in a fixed position regardless of the movement of the plane. But in spite of delicate balancing, the rotor does not remain exactly fixed. It takes ten days merely to assemble the parts, and the rotor is balanced on a strobmetric machine invented for the purpose. The instrument is subject to friction produced by the motion of the plane, and because of this friction it is continually precessed off course in an imperceptible movement known as "creep." Three or four times an hour, therefore, the pilot must reset the DG in reference to his magnetic compass, otherwise he would run the risk of drifting off his course.



Inspecting new automatic pilot *General Electric Company*

In the gyro-horizon, an air-driven gyroscope spinning on a vertical axis indicates the lateral and longitudinal position of the plane in relation to the horizon, artificially represented by the gyro. The gyro-horizon dial in the cockpit has a black face with a yellow miniature airplane painted on it and an indicator bar attached to the gyro and moving against the face of the dial. When the plane is dead level, the indicator is superimposed on the airplane; when it turns and banks the bar tilts accordingly; when it climbs the horizon bar falls below the airplane, and vice versa. The instrument has a small high-speed rotor driven by vacuum pumps (attached to the main engine) which suck air through filter intakes and into tiny jets pointed at the teeth of the rotor. The horizontal position of the gyro-horizon is maintained by four air ports attached to the base of the gyro. A tiny pendulum hangs over each port, and when the gyro is in precisely the right position the pendulum closes all ports. If the gyro is tilted, one of the pendulums swings so as to open a port, air being expelled through this aperture, thus pro-

(*Continued on page 24*)

KEEPING PRODUCTION HOT

By RICHARD B. MARSTEN, 6–45

Editor-in-Chief, The Tech Engineering News

ENGINEERING progress in time of war is truly amazing, not only because of the sharp increase in the number of new applications to industry, but also because of the rapidity with which these applications are adapted to modern production techniques. One application which typifies this rapid development is that of heat-treating metals by magnetic induction. The idea of induction heating is not new, although little was done with it until shortly after the present war began. The first patent utilizing the idea was issued in 1890 for an induction melting process, and a paper by Tesla, dated 1898, describes in detail a method of induction heating using Hertzian waves. No further progress was noted along this line until recently, when an investigation of the practical possibilities of electrical heating showed the true worth of the idea. As a result, it has been applied successfully to several thousand war production problems. Its commercial uses are just beginning to be realized.

War production techniques demand a minimum of time for every operation. Speeding up our production lines means increasing our output of vital products, but we cannot do this if one operation requires a much longer time than any other. Heat treatment of metals with conventional fuel furnaces is such an operation — it is an effective production bottleneck. The heat-treating of metals by magnetic induction eliminates this bottleneck, and is, besides, much simpler and more economical than heat-treating with furnaces.

Conventional fuel furnaces are impractical for high speed heating because their use makes it difficult to force heat to flow at a sufficiently rapid rate to the interior of the mass being heated. They are not adapted to modern production techniques because they are incapable of sufficiently rapid adjustment of the rate of heating to match sudden changes in production line speed. Induction heating does not have these drawbacks; in fact, it is unique in comparison with other heating processes in that it develops heat directly within the work, and eliminates "thermal inertia." It is this elimination of "thermal inertia" — the time lag between application of heat to the work and temperature rise in the work — and the ease with which rate of heating can be controlled, which make induction heating so much more desirable on the production line. Also, while it takes a lot of time, effort, and manpower to operate a furnace, it is a relatively easy matter for anyone to place a piece of work inside a heating coil and turn on the current for an appropriate length of time.

Because of these characteristics, the advantages of induction heating over heating by conventional fuel furnaces are many:

(1) A rapid rate of heating is produced, which is impossible with a fuel furnace.

(2) Difficulties inherent in methods requiring a high temperature gradient between the work and the medium used to force heat from the surface to the interior of the work are eliminated.

(3) Induction heating requires no physical contact between the work and the heating circuit, and thus the work may be kept at ground potential at all times.

(4) Induction heating facilitates making rapid changes in the rate of heating the work, such as would be required if a line were slowed up by a continuous process — for instance, welding two pieces together. Rapid changes of this type are impossible with a fuel furnace.

(5) Induction heating provides complete control of the area heated, and enables the heating to be confined within an arbitrary area, not necessarily the entire area of the work. This, too, is impossible with a fuel furnace.

(6) The application of heat to the work can be instantaneously suspended to prevent the occurrence of damage due to overheating in an induction heating unit, while in a furnace the application of heat can be reduced only gradually. This permits quicker heating in the induction heating unit, and reduces the time for the entire heating and quenching operation considerably.

(7) Greater accuracy of control obtained with induction heating permits results to be reproduced without variation. Because the fuel furnace is insensitive to small changes, its use does not entail such an obvious advantage to production.

(8) By using induction heating, the number of handling operations involved in the production of any article is substantially reduced. This, together with the great accuracy of control of the induction heating unit, tends to minimize the percentage of rejects from heating processes.

The process of induction heating is basically an application of Faraday's induction law. The work to be heat-treated is placed in the immediate vicinity of a certain type of air core induction coil, known as a work coil, whose size and shape vary for different types of work. A high-frequency alternating current is supplied to the coil and establishes in the coil a varying magnetic flux, which also links the work. This flux induces a potential distribution in the work, such that eddy currents in the work are established according to the right-hand rule relating magnetic flux and induced current, and it is the eddy currents induced in the work which actually produce the heating effect.

The rate of heating of the work is influenced by two things, the amplitude of the current supplied to the work coil and the frequency of this current. As the amplitude of the current increases, other factors remaining unchanged, the amplitude of the magnetic flux increases, and so the effective value of the induced current in the work is increased. Since heating effect varies as the square of the current, when the amplitude of the current supplied to the work coil is changed by any factor, the corresponding change in the rate of heating of the work will be proportional to the square of this factor.

Frequency, too, is important in relation to rate of heating. Faraday's induction law,

$$V = -N\frac{d\phi}{dt},$$

shows that, for a magnetic flux such as would be established in a coil by an alternating current, the induced voltage varies directly as the frequency and as the instantaneous flux. If the total flux linking the work is constant, a positive change in frequency produces a positive change in the induced voltage, and therefore in the induced current. This change will, as before stated, increase the rate of heating by a factor equal to the square of the fractional change in frequency, so that if the frequency is doubled, the rate of heating will be increased four times. This analysis, however, has neglected the existence of skin effect and the fact that the flux density decreases as frequency increases, if the magnetic intensity is held constant. These factors tend to reduce the advantages of the method. Also, it can be shown that there exists an optimum frequency beyond which greater efficiency can not be obtained, so that for best results one particular frequency should be used for a particular type of work. Usually the optimum frequency is of the magnitude of the radio frequencies. For hardening or annealing, however, where heating can be produced uniformly throughout the work without too much attention devoted to coil shape and dimensions, the frequency is not of critical importance. In such cases it may be just inside the audio range — say ten to twenty thousand cycles.

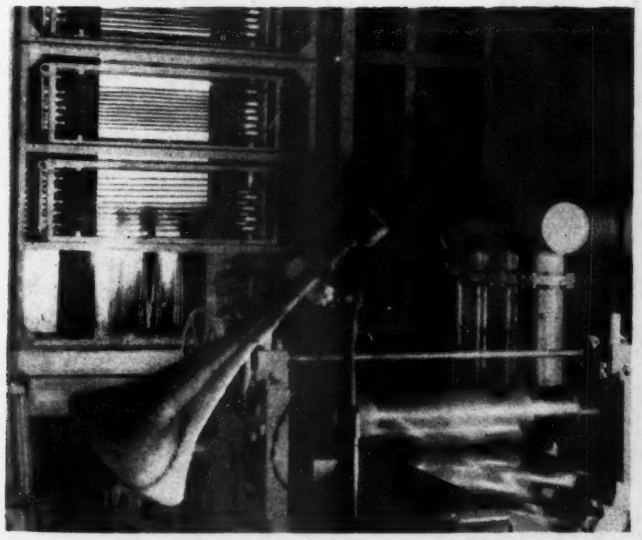
Certain heating jobs require special coils, whose geometry can be determined from an analysis of the heating requirements. Coils may be solenoidal, pancake-shaped, conical, box-type, or any of numerous other forms. For quick quenching after heating, the coil and work can be surrounded with a water-spray ring. In such an arrangement, the turns of the coil are flattened, permitting water passing between them to get more turns in the available space.

Surface heating, usually for the purpose of case-hardening, is accomplished with high frequencies, so as to utilize a more pronounced skin effect. If it is desired to heat an outside surface, the coil is placed around the object; an inside surface is heated merely by placing the coil within the object. Localized heating may be produced by allowing only the portion of the work to be heated to project into the heating coils, or by shaping the coils so that they cover only the area to be heated.

Once the optimum frequency and time for a particular coil have been determined, it is possible for even the most inexperienced operator to obtain uniformity of results on production runs. The heat-treatment merely involves placing the work in the proper position, stepping on a foot-control switch for the determined time, and then quenching, either with a water spray or by dropping the work in a quenching bath. Asbestos or other non-conductors can be used to center the work with respect to the coil.

Because of adaptability to large jobs as well as to small ones, induction heating is very likely to supplant other forms completely by the time the war is over. It is well on its way now, and more uses are being found for it day after day. The field for its uses has barely been opened.

As tin plate speeds downward between the induction coils, the tin is brought to the flow point in a fraction of a second. *Westinghouse*



For this hardening operation the inductor is a single-turn collar that also carries the quench fluid *Ohio Crankshaft Co.*

GENERAL VIEW OF THE BLAST FURNACES OF THE BETHLEHEM STEEL COMPANY

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SOCIALLY THINKING . . .

Much has been written about the place of the engineer in the postwar world. We have been told mellifluently of the super-technical age of the near future and the opportunities it will present — opportunities ranging from prefabrication to the geodetical study of India's vast unknown resources. But all too little has been written of the engineer as a citizen in the postwar world.

The engineer has a great responsibility. Because of him, the world is no longer an individualist's world. Through his research and his application of knowledge gained in it, the engineer has made our world today infinitely smaller. Modern methods of transportation and communication have produced a completely interdependent society. The new technological conditions have nurtured the advent of new social conditions which have made war more probable and, at the same time, have made war more destructive — all this unless peace can be organized.

In its fourth report, the Commission to Study the Organization of Peace states:

"New inventions have been utilized in a vain attempt to maintain or augment national sovereignty in a shrinking and interdependent world. The new popular consciousness has demanded such use in the vain hope that the state, if sufficiently powerful, might give people a security and prosperity which modern technology and economy seem to promise.

"New forces, which if channeled to human service might advance the welfare of all, when bottled within the narrow confines of national sovereignty, became explosive and destructive to all. . . .

"Unless the peoples of the United Nations comprehend the minimum requirements of a world organization able to maintain a just and lasting peace under the present conditions of technology and democracy, and are prepared to accept the changes in the traditional prerogatives of national states which such an organization requires, statesmen will lack the material for sound agreement."

In other words, it is up to *you* — each and every one of you. Your slide rule does not give you the right to be oblivious to the world that exists outside the realm of the laboratory. Instead, by dint of the very work you are doing, it becomes mandatory that you keep abreast of world events and that you take part in them. It is through the facilities evolved from your work that our present-day structure of economics and politics has arisen. You are an intrinsic part of them and therefore must not shirk the responsibilities connected with them.

As students, we are in a position now to fit ourselves for life after the war and to make sure that the foundations for that life, which will be laid in the peace treaties, will be neither of the type we shall have to break down in ten years nor of the type conducive to war thirty years hence.

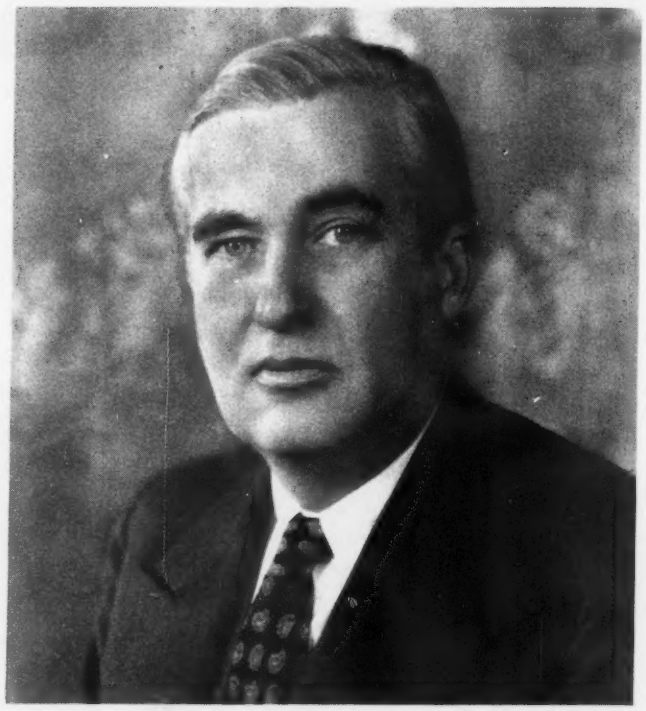
We must educate ourselves to think with perspective and understanding, and then put that education to practical use as soon as we are able through our privileges of voting and freedom of speech. We must wake up now to the fact that there are things in this world quite as important as whom we shall take to Junior Prom.

Realizing this, many students have instigated postwar planning groups and discussion groups which study problems ranging from labor to science and their effects on the world of today. There should be more of these groups. Through them we are given a voice in the problems which are of vital importance to the security of the peace, and therefore of vital importance to us.

For example, one of the largest and most powerful of these groups is the United States Student Assembly. The United States Student Assembly is not a political group of radical students attempting to change the world order. It is an organization composed of autonomous chapters from colleges and universities all over the country. It is governed and supported wholly by students, and its main purpose is to stimulate student thinking to a more aware political understanding. Not only is it doing this by providing speakers who are authorities in their fields (such as Leon Henderson and Jan Masaryck) for schools, but it is fostering good will and a much needed understanding between the peoples of many nations through its conferences which are attended by students from all over the world.

Groups like this are helping to produce a more civil-minded nation . . . and unless we realize the necessity of this, we shall shortly find ourselves the victims of another cultural lag akin to that which brought on the last two wars. M. R. S.

ALUMNUS OF THE MONTH



CHARLES EDISON

President Thomas A. Edison Industries
Former Governor of New Jersey

Charles Edison was born in West Orange, New Jersey, on August 3, 1890, the son of Thomas Edison, the "electrical wizard." Mr. Edison was educated at the Hotchkiss School, Lakeville, Connecticut, before entering the Massachusetts Institute of Technology in 1912. Mr. Edison, a member of the class of 1913, was in the general engineering course. While at Technology, Mr. Edison was active on the campus and was a member of the Delta Psi fraternity.

After leaving M. I. T., he went to work as a fifteen-dollar-a-week helper in a Boston electric company. Young Edison tried song writing, magazine publishing, and other pursuits before entering the businesses which had grown from his father's inventions.

During World War I when Thomas Edison served on the Navy Consulting Board, Charles Edison served as his assistant. The Navy Consulting Board consisted of eminent scientists and engineers who developed new weapons and ideas for the manufacture of war equipment.

When the war ended, Charles Edison returned to the peace-time industry. The Thomas A. Edison Industries were losing the phonograph business which had previously financed the research of the senior Edison and several smaller industries which generally showed a loss. In one particular case, the company had invested heavily in a huge plant for the manufacture of Thomas Edison's alkaline storage battery. No profits had been realized on the endeavor as the plant lay idle. Mr. Edison began the difficult task of building the industry into a paying concern. Unlike the storage battery which was constructed of cheap lead and zinc, the alkaline battery made use of expensive steel, nickel, and copper. The initial cost involved in the manufacture raised the market price far above that of the common storage battery. Purchasers not convinced of the long life afforded by the alkaline battery, bought the lead cell. Mr. Edison knew the answer to his problem lay in convincing the public of the alkaline battery through a progressive marketing campaign. The campaign was successful as his battery sold in huge numbers in a field keen with competition. The volume of sales expanded until the business climbed steadily to the top in the industrial battery field. This one instance is a fine example of the organizing genius and managing ability of Charles Edison.

After completing one successful endeavor, Mr. Edison began work on the rejuvenation of the other Edison industries. He transformed the iron ore concentrating mills, which failed with the discovery of the Mesabi deposits, into cement mills.

The Edison family had prepared for the depression by investing the profits in sound securities. The firm financial foundation of the company allowed the launching of two new enterprises during the depression. The Edison Company used this slack time to rebuild and modernize their plants and facilities. This far-sightedness enabled the company to be ready when the depression passed and normal times returned.

Charles Edison became intrigued with the sealed-in-glass idea and he continued the company's research in these lines after his father's death. The research continued until 1941 when a major application was discovered. Switches constructed of sealed-in-glass are used in airplanes for they cannot fail in the high altitudes a plane must travel. The present war gave impetus to the enterprise and the manufacture of instruments based on this idea grew tremendously. Today practically every Army and Navy plane is equipped with a product of this division.

Mr. Edison left the Edison Industries to serve the country in various capacities during the following seven years. In 1933 Mr. Edison served as a member of the New Jersey State Recovery Board and the Regional Labor Board organized under the National Recovery Act.

During 1934 Mr. Edison served as Regional Director of the Federal Housing Administration for the region which included the States of New Jersey, Maryland, Pennsylvania, and Delaware. Before serving in this capacity, he spent considerable time assisting the preparation of legislation which created the Federal Housing Administration. The following year Mr. Edison was appointed a member of the NIRA by the President. Returning to New Jersey he resumed his duties as State Director for the National Emergency Council.

In the fall of 1936, Charles Edison was appointed the Assistant Secretary of the Navy by President Roosevelt. He served in this capacity until the death of Secretary Claude A. Swanson, when he was appointed Secretary of the Navy by the President.

Returning to New Jersey, Mr. Edison was elected Governor of that State in November of 1940. He served a term as Governor from January of 1941 until January of 1944. With the expiration of his term, Mr. Edison returned to the Edison Industries to resume his position as president. He was heartily welcomed back after his seven years leave of absence spent in the public welfare.

Charles Edison is one of the great men who have gone from M. I. T. into the industry of America. His career is unique, for unlike the sons of numerous other great men, he has risen to a position of prominence through his own abilities and efforts.

Official U. S. Army Photo.

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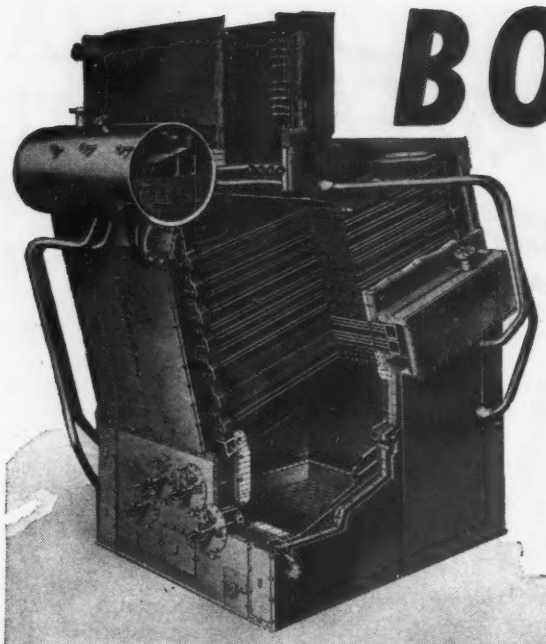

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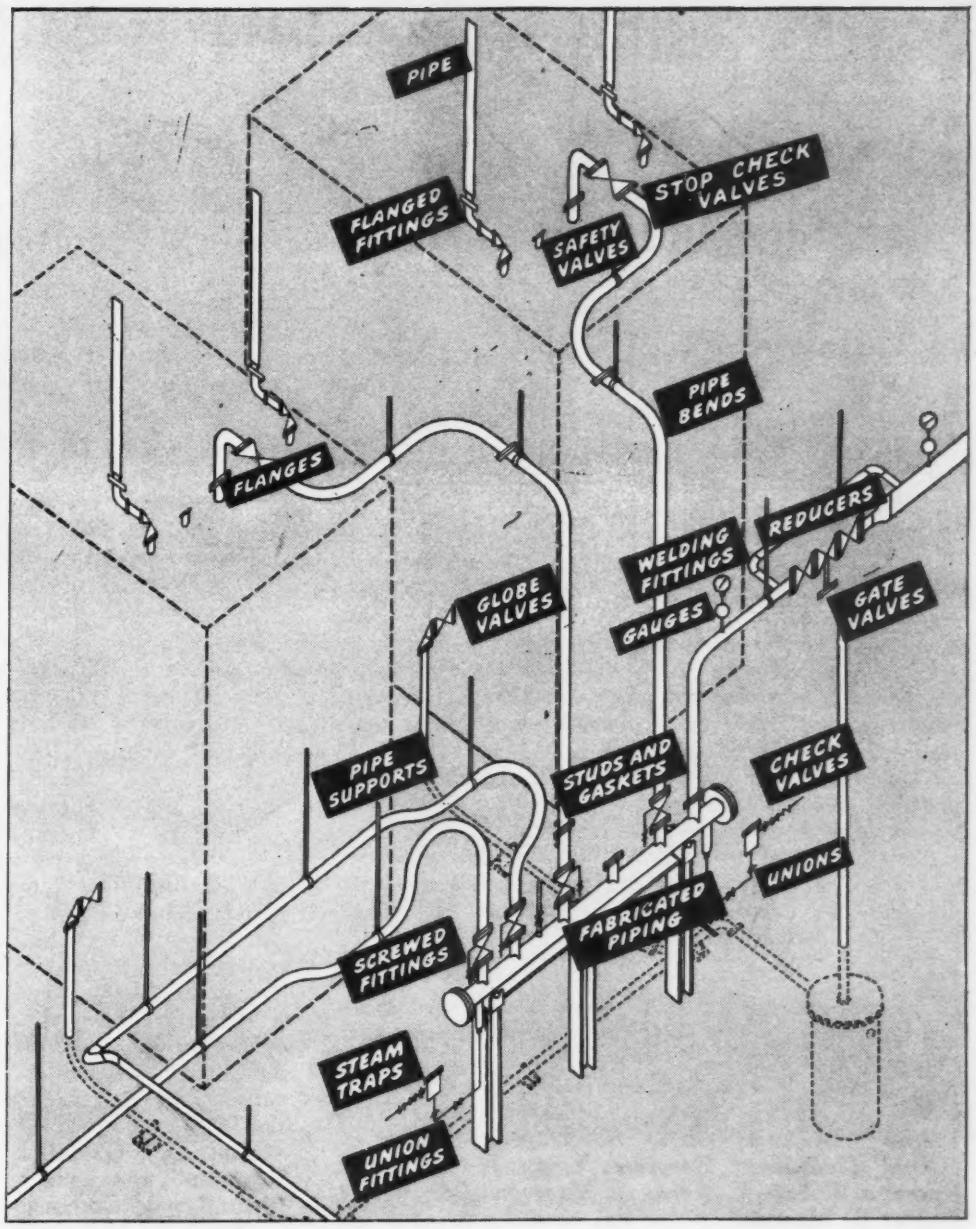
General view of the low side of the open-pit copper mine of Chuquicamata, Chile, with the mill and part of the town in the background

Three Lions

IT TAKES PIPING TO MAKE IT WORK



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HONORARY AND PROFESSIONAL SOCIETIES AT M. I. T.

TAU BETA PI

The Tau Beta Pi Association, National Honorary Engineering Fraternity, was founded in 1885 at Lehigh University. Membership in Tau Beta Pi is considered the highest honor conferred on an undergraduate engineer. Juniors who are scholastically in the upper eighth of their class, and seniors in the upper fifth, are eligible for election, and from these, men are chosen who have shown leadership in Institute life, who possess exemplary character, and who have shown breadth of interest both inside and outside of engineering.

During the past term, the M. I. T. chapter, Massachusetts Beta, held a number of dinner meetings at which the increasingly serious question of Engineering Unions was considered, with guest speakers, both pro and con, leading the discussion. A closing social picnic-gathering was pronounced a huge success.

ALPHA ZETA OF ALPHA CHI SIGMA

Founded at the University of Wisconsin on December 11, 1902. Present status fifty-three chapters with a membership of 18,041.

Officers for the current semester have been elected as follows: Master Alchemist, J. George Schudel; Vice-Master Alchemist, David A. Trageser; Treasurer, Harold Thorkilsen; Recorder, Keith E. Whitmore; Reporter, Robert V. Horrigan; Master of Ceremonies, Robert R. Marshall.

Professor Avery A. Ashdown was guest speaker at the regular July meeting and his timely topic "Penicillin and Its Overdone Publicity" was well received by the members.

The chapter will welcome visits from inactive members and members of other chapters who are at present stationed at Technology.

K. E. WHITMORE, *Recorder for Alpha Zeta.*

INSTITUTE OF AERONAUTICAL SCIENCES

The Institute of Aeronautical Sciences enjoyed a very successful term this spring. In addition to receiving forty-five new members it laid the groundwork for many interesting activities this summer and next fall. The past term was highlighted by the visit of Mr. John C. Leslie ('28), general manager of Pan-American Airways' Atlantic Division, who gave an interesting talk on "Airports of the Future."

The national organization of the Institute of Aeronautical Sciences, through its publication *Journal of the Aeronautical Sciences* and the Kollsman Aeronautical Library in Radio City, affords both the graduate and the undergraduate excellent opportunities for keeping up with the progress in the aviation industry. General Jimmy Doolittle (M. I. T. '24) is the president of the national organization.

The present officers of the M. I. T. chapter are:
Chairman, JOSEPH T. LESTER
Vice-Chairman, ROBERT L. HUNTER
Secretary-Treasurer, RICHARD H. HINCHCLIFF
Activities Chairman, LEONARD F. GLANCY

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

The M. I. T. Student Chapter of the American Institute of Chemical Engineers, an old and respected professional society at Tech, presents many valuable features to undergraduate chemical engineers. Designed to bridge the gap between the methods encountered in chemical plants, this active society holds monthly meetings at which timely movies are shown or authoritative lectures given. Frequent plant visits widen the members' acquaintance with the modern methods used in chemical engineering.

So far this year the program has included: "The American Institute of Chemical Engineers" — a lecture by Professor Stokes; "The Chemical Industry after the War" — a talk by Prof. W. K. Lewis; films entitled "Catalysis," "Oxidation and Reduction," and "Rate of Reaction"; and a plant visit to the Cambridge Branch of the Liquid Carbonic Corporation.

Plans for the summer term as tentatively formulated are: the showing of movies on varied engineering subjects; the factory inspection of nearby non-war plants; and the giving of numerous lectures on applied chemistry.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

In prewar days Courses VI and VI-A boasted of having four major extra-curricular activities — *Hexalpha*, *The VI-A News*, *Sparks*, a yearly magazine published by Course VI-A, and the Student Branch of the A. I. E. E. At present, because of wartime limitations, the A. I. E. E. Branch is the only active electrical engineering student activity. Since the suspension of the other electrical engineering groups the A. I. E. E. has taken over many of their responsibilities. In view of these added duties and of an increased interest in the organization, the A. I. E. E. has obtained Room 10–206 for its branch office and will maintain office hours from 4 p.m. to 5 p.m. Monday through Friday during the coming months.

The past term's A. I. E. E. activities were high-

(*Continued on page 22*)

Women flame-fashion steel for war

Using the fastest of cutting tools—the oxyacetylene flame—in Airco multiple-torch gas cutting machines, women operators throughout industry quickly fashion steel into the vast array of shapes required for a host of war products.

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(*Continued from page 20*)

lighted with talks by Mr. R. F. Field, of the General Radio Company, and Professors Arguimbau and Wilbur, of M. I. T. A plant trip was also conducted to the Boston Police radio transmitter.

July 1, 1944 GEORGE A. WILSON, JR., *Secretary*.

AMERICAN INSTITUTE OF METALLURGICAL ENGINEERS

Due to the lack of civilian students around Technology the A. I. M. E. Student Professional Society has remained dormant for the past year.

Since the establishment of the Navy V-12 Unit at Tech, however, the number of metallurgy students has increased and along with it interest in the A. I. M. E.

In the past, the A. I. M. E. Student Society has held two chowder parties a year in the labs along with several talks by eminent metallurgists in the Boston Area. It is hoped that interest in the Rally will be sufficient to merit a reinstatement of the Metallurgical Society to an active status.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The Student Chapter of the American Society of Civil Engineers is one of the oldest student professional societies at Technology. It has always found ready support among the students of Course I and Course XVII. Lacking occasionally in competent leaders, it is seldom lacking in support from the student engineers who feel that the contacts it offers with the professional world of Civil Engineering make it an integral part of their training of which full advantage must be taken.

The programs for the Society meeting are composed occasionally of material supplied by the parent society pertaining to problems encountered on recent construction projects throughout the country, and when possible these programs are supplemented by the lectures of men high in the engineering profession on their experiences in professional life. Social meetings, formerly a regular feature of the Society, have been largely discontinued for the duration.

As in all professional societies, we look forward to the time when a relaxed schedule will enable the students to take a greater interest in their own Society.

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AMERICAN SOCIETY OF MECHANICAL ENGINEERS

In June the Technology branch of the American Society of Mechanical Engineers concluded a successful semester of activities with a dinner meeting at the Smith House. At this meeting plans for the coming term's program were announced. These included a series of lectures on engineering ethics, several field trips to industrial plants, and a week-end at the Tech Cabin.

The most predominant of the term's activities was the series of lectures on jet propulsion by Professors Keenan, Soderberg, and Taylor. These lectures drew large audiences composed of not only American Society of Mechanical Engineers members but also other students and people attached to M. I. T.

THE NAVAL ARCHITECTURAL SOCIETY

The Naval Architectural Society arranged a program of events last term which proved of great interest to its many members. These included: talks by Prof. C. R. Soderberg on "The Gas Turbine" and Mr. Fred Ashworth '24, Vice-President of Merriman Bros., on "Sales Engineering in the Development of Yacht Fittings"; meetings of the New England Association of Naval Architects, with talks by Carl Lindquist on "Rigging" and Rear-Admiral Theobold, Commandant of the First Naval District, on "Naval Tactics"; and a visit to Robinson's Shipyard, Ipswich, to become acquainted with composite construction in the building of small craft.

The present officers are: T. S. Emberton, President; R. W. Ayling, Vice-President; and P. L. Bishop, Secretary-Treasurer.

A program of interesting events and talks is being arranged for the coming term, the emphasis placed on subjects not covered in any of the professional courses so as to point out the many varied opportunities of the shipping world.

T. S. EMBERTON, *President*.

ROCKET RESEARCH SOCIETY

The members of this organization are students and engineers keenly interested in the development of rockets and jet propulsion. The Society aims to acquaint members with the theory and application of rocket power, and to promote research in aeronautics, fluid

(*Continued on page 24*)

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HIGHER ORDER OF QUALITY AND ECONOMY

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THE BULLETIN BOARD

(*Continued from page 22*)

flow, high-temperature metallurgy, fuels, ballistics, and other allied fields. Both library and laboratory research are being conducted.

The Society designed and built a liquid-fuel rocket motor which was bench-tested in January 1944. A new and improved model designed from the results of these experiments is now ready for test. A set of technical papers written by former members has been published and distributed to ordnance and rocket research laboratories as well as to individual experimenters. Persons seriously interested in rocket research may obtain copies at the weekly meetings held on Mondays at 7 p.m. in the Litchfield Lounge of Walker Memorial.

STRAIGHT AND STEADY

(*Continued from page 11*)

ducing an unequal pressure in the gyros. The rotor then precesses at right angles to the point of pressure and the gyro automatically rights itself.

The first modern gyropilot was built in 1932, at the time that Wiley Post was preparing for his second round-the-world flight. The instrument used at the present time sells for about $5,000, and has 820 precision parts, not counting screws, washers, etc., or the mechanical system for translating the gyroscopic indications into movements of the ailerons and elevators. In other words, while a gyroscope is exceedingly simple, a gyroscopic instrument is tremendously complicated, especially the "automatic pilot."

The main parts of the gyropilot are two gyros, one horizontal and one vertical, controlling the flight level on three axes. The "muscle" of the gyropilot is a unit consisting of a number of metal rods leading through cables to ailerons and elevators, and moved by oil pressure acting on the ends of the rods. The "nerves" of the gyropilot are the complicated links between the air-driven gyros and the oil-driven rods. If the plane moves off its heading and its horizontal level, both gyros are affected. The instruments measure the changes in direction and altitude, and the "nerves" actuate the rods that move the rudder and ailerons to put the plane back on its proper course. If no "follow-up" instrument was included in the system, the plane would take a zigzag course with a series of sharp oscillations. This "follow-up" instrument is a monitor in the central circuit that regulates the degree and duration of rudder, aileron, and elevator application, and takes up the lag in the plane's response to gyropilot directions.

Gyroscopes have solved many small but very important tasks. In several states, cars that are employed in road mapping are equipped with directional gyros. When the automobile is driven around a curve, it is possible to tell the degree of the curve from the directional gyro.

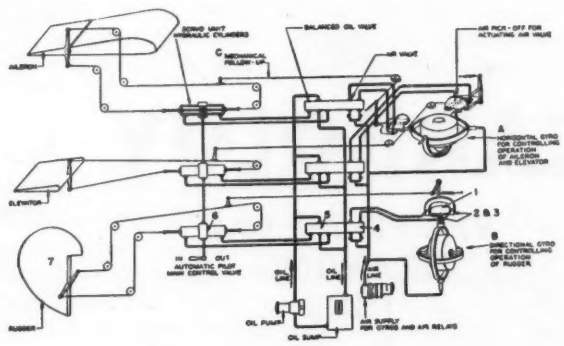
Gyros are mounted on railroad cars to detect uneven track and to check the bank angle on turns and the per cent of rise or fall of the grades.

The gyroscope has solved one of the big problems of oil-well drillers. They had always been bothered by the tendency of bore holes to shoot off at strange angles instead of following the desired course. Sometimes the holes drifted hundreds of feet into another operator's preserve. Now drillers use a specially mounted gyroscope that, when lowered down the bore hole, indicates all change in direction.

An instrument that is a combination of the magnetic compass and the directional gyro is just coming out of the experimental stage. This instrument eliminates the "creep" of the directional gyro and does away with the oscillations that make the magnetic compass so faulty in an airplane. The movement of the magnetic needle in the instrument opens and closes air-pressure jets that cause the gyro to precess until it points at magnetic north. At the same time, the gyro itself stabilizes the compass element and insures steady readings regardless of the motion of the ship.

Besides the uses already mentioned, gyroscopes are serving many more important purposes in this war. They hold guns steady for firing in spite of the diverse movements of the vehicles; they are a part of our most important bombsights; they help steer torpedoes and scan the sky for evidence of the enemy. Many of their uses cannot be revealed until after the war.

Automatic pilot operation



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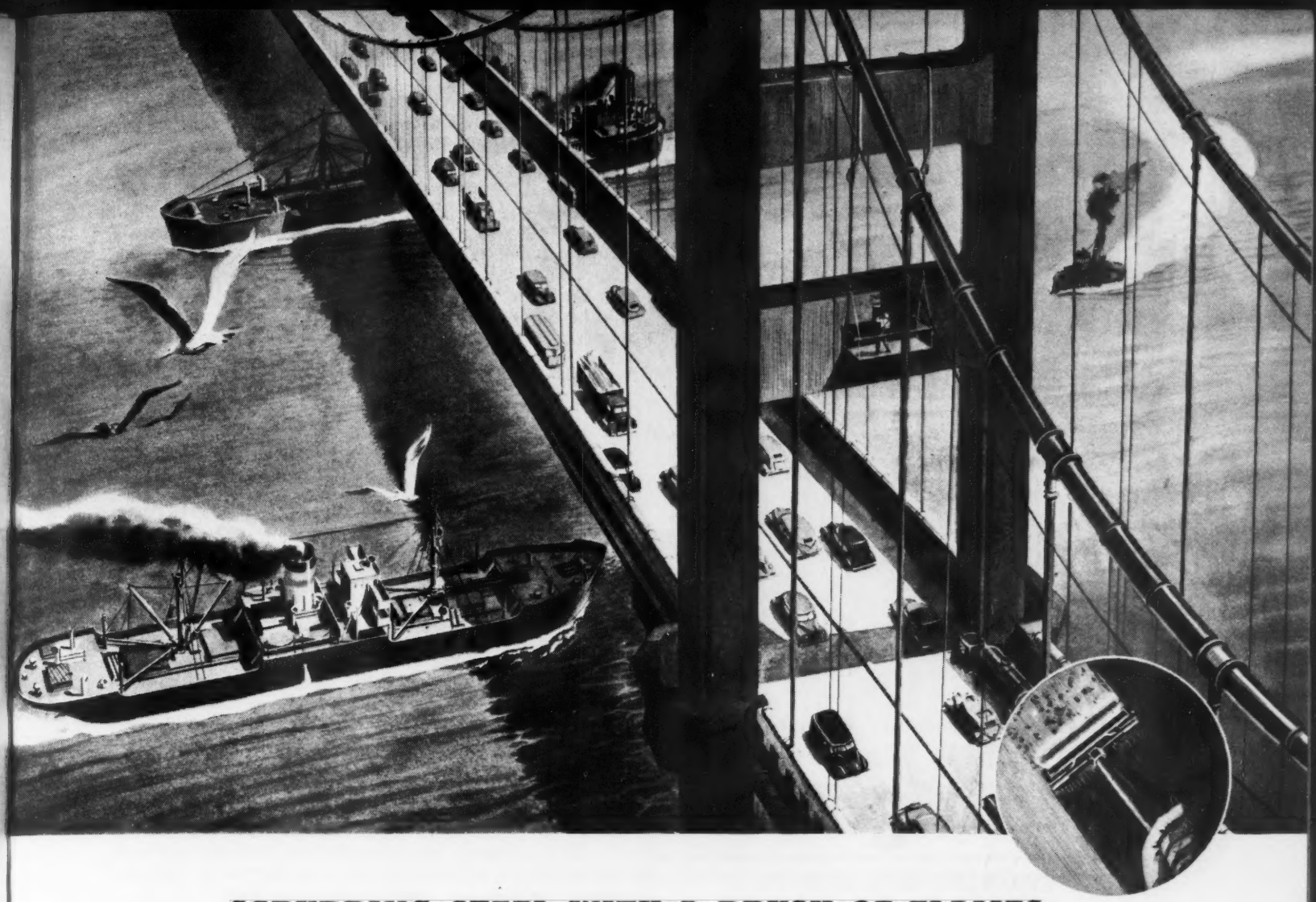


SCRUBBING STEEL WITH A BRUSH OF FLAMES

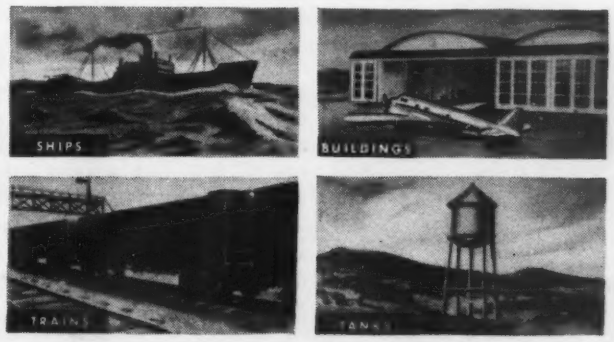
THE SIMPLE process this man is using is called "flame-priming." It was developed by THE LINDE AIR PRODUCTS COMPANY.

When the fiery "bristles" of oxy-acetylene flame sweep over steel, the intense heat causes scale to expand and pop loose. This heat thoroughly dries the surface and consumes or neutralizes any oil, rust, and other foreign matter that may be present.

Applied to steel just before the first coat of paint is put on, "flame-priming" makes paint go further and last longer, and makes painting a more permanent means of preventing corrosion.

Oxygen, acetylene, and many machines and techniques for treating, cutting, and fabricating metals have been made available to industry for years by LINDE and other Units of UCC.

FLAME-PRIMING *is used on . . .*



. . . and wherever steel must be painted

Architects, public officials, consulting engineers, production managers, utility executives, contractors, educators and designers are invited to send for the non-technical picture-caption booklet, H-7, "Linde Oxy-Acetylene Processes." This booklet shows the wide range of Linde methods for cutting, joining, forming, treating, and cleaning metals. It also contains elementary information on the essential products . . . Linde Oxygen, Prest-O-Lite Acetylene, Oxweld Apparatus, and Union Carbide.

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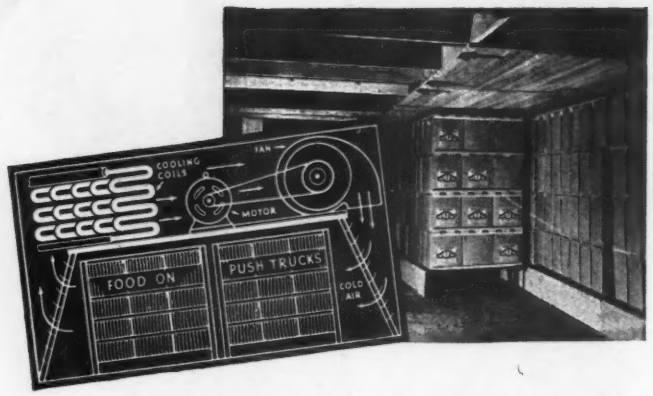


Frozen Food Packers Prefer

Typical of the hundreds of big packing plants doing quick-freezing is that of the C. H. Musselman Co. at Biglerville, Pa., where fresh apples, berries and other fruits are handled by the thousands of pounds. This firm chose Frick-freezing Equipment after using Frick Refrigeration in its several plants for nearly ten years.

Frick-freezers are setting the pace in revolutionizing the food industries! Millions of pounds of foods are frozen in season every day with Frick equipment. Let us give you the whole story: write for Bulletin 147

TRADE FRICK MARK

Frick Co., Waynesboro, Penna.

Refrigeration

STRAIGHT AND STEADY

(*Continued from page 24*)

One of the major tasks in the production of gyroscopic instruments is the design and production of electric motors that can drive the gyros at their high speeds of several thousand revolutions per minute. In one instrument, the motor must bring its gyro flywheel to full speed of 12,000 r.p.m. in two-tenths of a second. This motor develops 22 h.p. but weighs only 10.5 pounds. To get the 600 amperes into the armature, the brushes must work at a current density of 1600 amperes per square inch.

Directional compass Sperry

Some instruments require motors of very accurate construction. The weight must be almost perfectly distributed to insure absolutely vibration-free operation. The machines used to balance the five-inch diameter flywheel of these motors can detect an excess or shortage of weight of but one ten-thousandth of an ounce. A burr on the balance screw of the wheels will affect their operation. Even the standard progressive winding cannot be used in the d.c. armature because it does not distribute the mass of copper around the rotor with sufficient uniformity to provide the precise balance required. These small motors will bring the gyro flywheel up to 1600 r.p.m. in about 40 seconds. After the power is shut off, it will coast one-half hour or longer before stopping.

Gyro horizon Sperry

Other small gyro motors consume but three watts (about 1/250 h.p.). The rotors for these motors, including commutator and shaft, are about the diameter and length of a thumb. The motors are totally enclosed and are confined in tight housings along with other heat-producing apparatus, thus increasing the temperature problem. Were it not for special low-loss iron used for a.c. stators and d.c. armatures, the motors would literally burn.

THIS IS M. I. T. — ARCHITECTURE

(*Continued from page 7*)

planning and thinking out problems has fitted them for almost any work which they were called upon to do. Part of the hue and cry resulting from the alleged uselessness of the architect brought various proposals that the architect should become a master builder and an engineer. Now the architect, like all other professional men, is a human being. He has his limitations and he must consider the rights of the other professional men active in the same field. The architect's activities are so widespread that it will not be possible for him to become an engineer and a scientist. He should, however, be thoroughly acquainted with the basic elements of both fields of activity and thereby come to a better understanding and appreciation of the engineer and the scientist to recognize their usefulness and to know when to call them in on his building project.

It is amazing how shortsighted we have all been with respect to the everyday occurrences in the construction industry. Before our very eyes cities have been disintegrating and falling apart socially and economically. All our education has been focused on the individual building and none of it on the cities of which these buildings are a part. This is not alone true of the architect, it is true of all elements having to do with the construction industry. They have been isolated and interested in present-day matters. They have neglected to plan for the future. No individual or group of individuals can be made responsible for this situation. It is mass guilt. It stems back to the failure of our educational institutions, from the high schools up, to train men to think beyond their own era. However, one can be comforted by looking back through history to see how slowly mankind has developed throughout the ages. We can then take hope that, if we all recognize the shortcomings of our various groups, we can then begin to co-ordinate our efforts to come to a better understanding of each other's problems and a sympathy for our mutual difficulties.

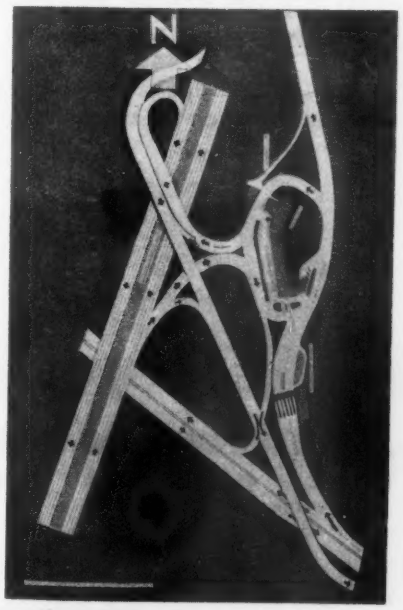
The construction industry, so far as we can trace it and know something about it, stretches back for fifty centuries. We can learn much from the past centuries, if we delve into the history which has recorded the activities of our industry during this long period of time. When we realize that the activities of our various professional organizations and our schools have been effective for less than half a century, we then realize that we are merely in the early processes of formulating a building industry and co-ordinating the efforts of its various divisions. The fact that architects and engineers in schools may work together on a specific problem is not enough. Somewhere in the course, they must be taught the relationship between the two, so that their activities in the future will be sympathetic and directed

A master plan for six communities in the Boston Metropolitan District

toward the well-being of mankind.

The future belongs to those who are prepared. Let us hope that the young men going through our schools and starting their professional careers will recognize their responsibility in the development of a world in which all men shall have the right to work for a living wage and that all the buildings, in which our human activities take place, shall be useful and beautiful to look upon, that our cities shall not be the shambles they are now, but great and beautiful organizations of structures which will give happy, peaceful, and beautiful surroundings in which to work and to live.

Gateway and service island on a national superhighway



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O W I Photo by Palmer, in an Allegheny Ludlum Plant

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BEFORE STAINLESS GETS ITS WINGS

REDUCE ACCIDENTS!

In 1941, accidents were first cause of death among men from 22 to 38 years of age. The productive man-days lost were enough to build twice as many battleships as now possessed by the combined Allied Navies.

These are losses that *can* be avoided. Don't take unnecessary risks at any time; and later, when you enter business life, remember that carelessness is the single greatest factor in human and economic loss.

A GREAT deal of costly processing is done on stainless steel, to secure the physical characteristics and surface finish required for the particular war job it is to perform. But one day all the rolling, heat treating and surface finishing is completed, and bright sheets of Allegheny Metal lie ready for final inspection and shipment to the war plants.

They're *right,* those sheets—flawless of surface and true to specifications. They'll do their job and more—which is what everything and everybody *must* do, in a war like this. In the case of stainless steel, that job is the supplying of vastly increased strength with equal or decreased weight, and high resistance to heat and corrosion. These are qualities of great value now, and of even greater promise for the future.

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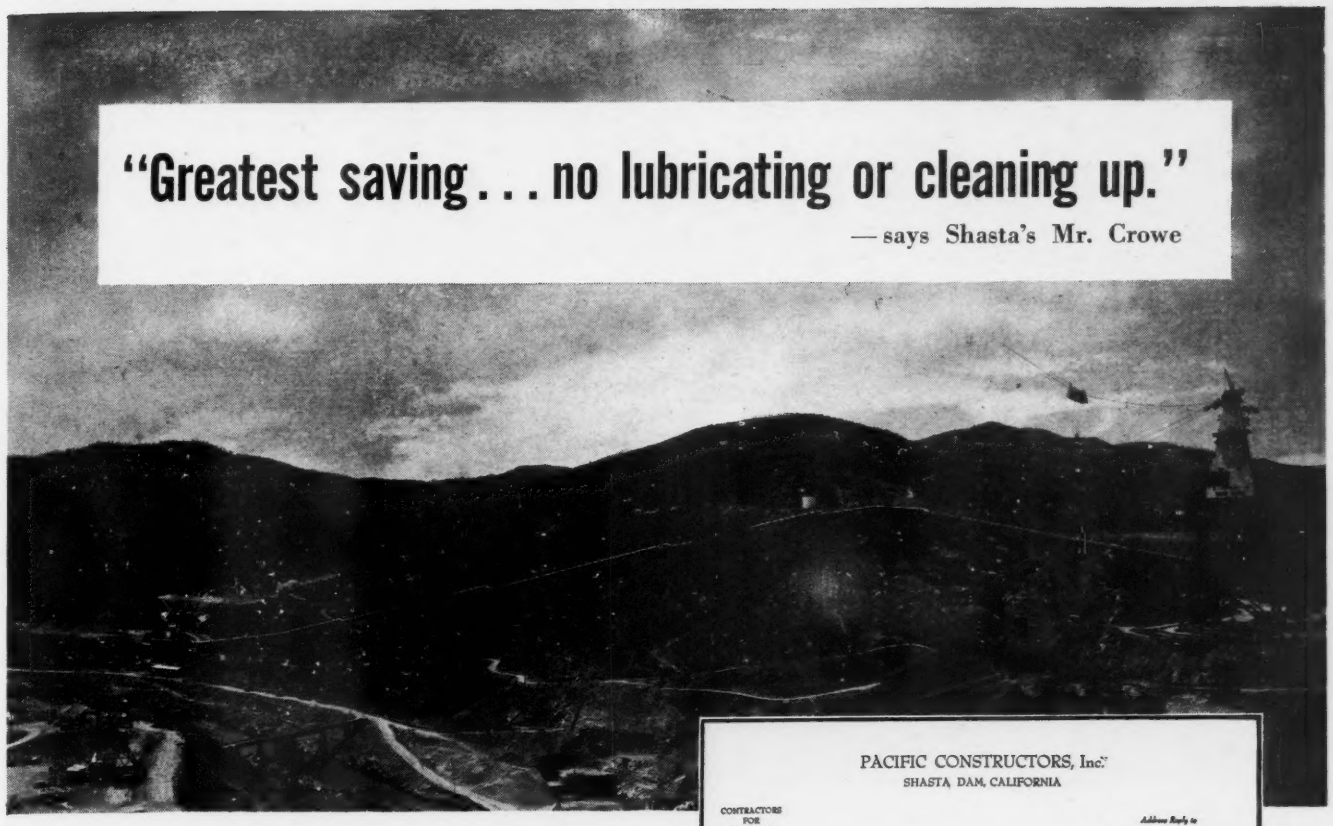

PACIFIC CONSTRUCTORS, Inc.
SHASTA DAM, CALIFORNIA

CONTRACTORS FOR SHASTA DAM

Address Reply to
Shasta Dam, California
January 18, 1944

The Conveyor Co.
3260 E. Slauson Avenue
Los Angeles, California

Gentlemen:- Attention: Mr. W.E.Sams, President.

As you know, our use of the troughing conveyor system at Shasta Dam using New Departure Conveyor Roll bearings and installed by your company, is about completed.

When this job was being discussed at the start, we questioned the use of New Departure Sealed Conveyor bearings in service on 36 inch belts carrying six inch rock at 450 feet per minute.

Considering that even in the building of Boulder Dam we had not had as large a conveyor problem, we were reluctant to experiment any more than we had to in designing equipment for Shasta Dam.

Now, after nearly four years with extremely low and satisfactory maintenance costs, approximately 13,000,000 tons have been handled with this equipment.

We know that the greatest saving in the use of this design was in the elimination of lubricating and of cleaning up after lubricating, made possible by the use of sealed bearings.

It is a pleasure to advise you that your troughing idlers using New Departure Sealed bearings have been very satisfactory.

Yours very truly
PACIFIC CONSTRUCTORS, INC.
By G. G. Crowe
General Superintendent

FTC:V

THE last link in the 10-mile Shasta Dam conveying system is a mile and a half unit made by the Conveyor Company of Los Angeles, using 17,500 New Departure Self-Sealed Ball Bearings of two types.

For nearly four years this system has handled 13 million tons of rock as big as 6 inches in diameter.

The satisfactory service obtained is proof that these self-sealed "Lubricated-for-life" ball bearings are not only equal to the job but effect great savings in time and lubricant.

New Departure engineers will be glad to suggest how you may use these ball bearings to your own advantage, when they are again available. Ask for Booklet C.

New Departure, Division of General Motors Corporation, Bristol, Connecticut. Los Angeles, Chicago and Detroit.

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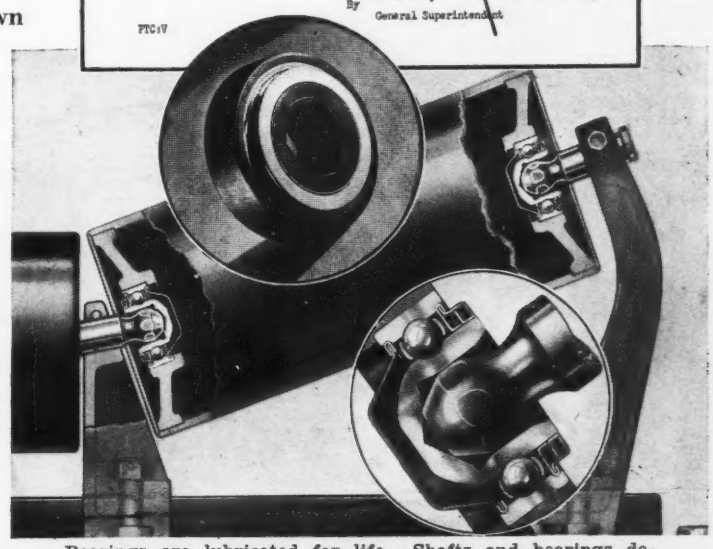
BALL BEARINGS

Nothing Rolls Like a Ball



Bearings are lubricated for life. Shafts and bearings designed to prevent cramping or slippage. Units easily set up.

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GE Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD

WATCH THAT PITCH

ON-THE-SPOT pictures of the world Series games may not reach your television set this season, even if you are lucky enough to have one. But after the war, new equipment will be able to transmit such pictures over large areas instead of the short distances television now covers.

This is no crystal-ball kind of prophesy. It's a fact accepted by men who are working with a revolutionary new disc-like electronic tube developed by G-E engineers for the army and navy.

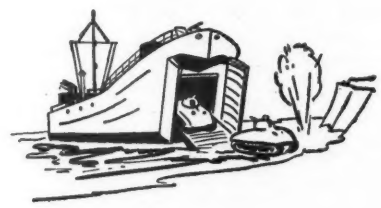
This new tube will aid the ultra-high frequency relaying of television programs. Consequently national networks in television may be built similar to those already established in the broadcasting field. Pictures of events of national interest, like that baseball game mentioned above, will go all over the country while the events are happening; no words in the world can do justice to a home run.

CABOOSE CALLING . . .

THAT'S the sort of short-wave message which may soon be filling the ether. Radio equipment, G-E short-wave FM apparatus, was used for the first time recently for end-to-end communication on a train.

Through tunnels and around curves on a 1,140-mile run, the signals were audible; communication failed only in the 6.2-mile Moffat Tunnel through the Continental Divide.

In the future, radio communication systems will probably be installed on trains where many cars separate locomotive and caboose. As a result, train runs will be faster and safer.



AT THE FRONT

WHEN an invasion craft approaches a beach-head under enemy fire, there is no time to be lost. There can't be any delays, for example, when an LST opens its large doors and spews out its landing ramp to provide the tanks with a way to the shore.

G.E. has built the motors that operate bow door and ramp gate equipment on most of the LSTs. This is not the only important job G.E. takes care of on these ships. But it is one of many cases where dependable G-E mechanisms allow our fighting men to spend most of their effort taking care of the enemy. *General Electric Company, Schenectady, N. Y.*

Hear the General Electric programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds You Buy.

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